REMARKS

Claims 1-11 are pending in the present Application. Claim 1 is independent.

CLAIM REJECTION – 35 U.S.C. 103

Claims 1-11 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Masaharu et al. (JP 10-271341, hereinafter Masaharu) in view of Juday et al. (U.S. Patent 5,067,019, hereinafter Juday). In the alternative, claims 1-11 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Zimmermann (U.S. Patent 5,185,667) in view of Juday. Applicants respectfully traverse these rejections.

UNCLEAR REJECTION

A formal statement of rejection has been made with respect to Zimmermann and Juday, and in the alternative, with respect to Masaharu and Juday. However, other sources are implicated that are not formally part of the rejection, i.e., not established in making a case of *prima facie* obviousness. For example, the rejection notes a teaching by Japanese Publication 6-295333, and appears to rely on that reference with respect to claims 5 and 6, but does not make the reference part of the rejection.

Also, so-called admitted prior art is mentioned in the rejection as the motivational basis for the Juday reference. Specifically the rejection states, "The only thing different from the prior art admitted by applicant and the claimed invention ...", and "It would have been obvious to one of ordinary skill in the art at the time the invention was made to have substituted the hardware image

transformation as taught by Juday to the software image transformation section of prior art admitted by applicant so as to ..." Because neither "admitted prior art" nor Japanese Publication 6-295333 were formally made part of the rejection, Applicants will not treat those sources in addressing the rejection.

The Claim Rejection

The Office Action alleges that Zimmermann discloses an omniazimuthal visual system including an optical system capable of obtaining an image of 360° view field area therearound and capable of central projection transformation for the image. The Office Action further appears to allege that the only thing different from the present claimed invention is that the image transformation section of Zimmermann uses software similar to the related art (Figure 10) of the application whereas the claimed invention uses hardware. Applicants disagree that Zimmermann discloses an optical system capable of central projection transformation, as well as a comparable image transformation section to that in Figure 10 of the present invention.

Zimmermann discloses an optical system having a fisheye lens 1 with a 180° field-of-view that shows the contents of the environment throughout a hemisphere (Zimmermann, column 3, lines 26-28, lines 57-60; column 4, lines 26-30; column 5, lines 13-15), a camera 2 and image capturing device 3 that converts an optical image into an electrical signal then digitizes the electrical signal. (Zimmermann, column 3, lines 28-31, lines 60-64). Zimmermann's fisheye lens is not capable of obtaining an image of 360° field-of-view. In particular,

although the image of Zimmermann can be rotated through 360° (e.g., column 4, lines 53-54), the fisheye lens itself is not rotated (Abstract).

As disclosed in the present Specification, a hyperboloidal mirror is an optical element which enables a 360° field-of-view throughout a sphere. The optical system containing the hyperboloidal mirror carries out a precise central projection transformation. Furthermore, this central projection transformation can be carried out over the contents of the sphere with just linear operations. As further disclosed in the Specification, using a wide-angle lens (e.g., fisheye lens), an image transformation requires nonlinear operations. (Paragraph bridging pages 3 and 4). Because Zimmermann uses a fisheye lens, a central projection transformation is not performed. In fact, because Zimmermann uses a fisheye lens, complex mathematical operations are required in order to transform the hemispherical image into a corrected image (Zimmermann: column 5, line 54, to column 7, line 54). Thus, Applicants submit that Zimmermann's optical system, being based on a fisheye lens, is not capable of central projection transformation and requires complex non-linear operations.

Because, Zimmermann teaches an optical system that is not capable of obtaining an image of 360° view field area therearound and is not capable of central projection transformation, it does not teach an image transformation section for transforming the image data of the 360° view field area image. Zimmermann discloses as key successes of its invention (i.e., the capability of carrying out image transformations at real-time video rates -30 times per second; column 4, lines 44-47): 1) the entire image need not be transformed, only the

portion of interest and 2) the required mathematical transform is predictable based on the lens characteristics (column 4, lines 16-21). Thus, Zimmermann explicitly points out that its invention is limited to transforming a portion of interest. Further, Zimmermann discloses that its transformation is for obtaining a perspective corrected image (column 5, lines 39-42).

A key aspect of the present invention is that it is capable of handling the transformation of an entire image of 360° view field area. By using an optical system capable of central projection transformation, an image transformation can be carried out with only linear operations. Thus, the present invention is implemented in hardware that doesn't require storage of intermediate results and can handle transformation of the entire image of 360° field-of-view within a delay time (Specification, paragraph bridging pages 3 and 4; page 10, lines 10-18). Thus, Applicants submit that the difference between Zimmermann and the present invention is not just a matter of software versus hardware.

These same arguments apply to Masaharu, which the Office Action relies on for comparable teachings to those of Zimmermann.

Differences over Juday and Zimmermann/Masaharu

The Office Action relies on Juday for allegedly teaching hardware components that perform functions of Zimmermann's software components. In the alternative, the Office Action relies on Masaharu for teaching software components. Thus, the following remarks apply to Masaharu, as well. Applicants disagree that the combination of references teach the claimed invention.

Applicants submit that there is no suggestion or motivation to modify Zimmermann with the teachings of Juday. Applicants submit that the combination of the teachings of Juday with Zimmermann would render the imaging system of Zimmermann unsatisfactory for its intended purpose. See In re Gordon, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984). Juday is concerned primarily with providing a mapping or transforming function to produce displays that can accommodate certain defects in visually-impaired people (column 4, lines 4-18). It preferably includes a conventional video camera (column 5, lines 6-9).

Zimmermann is directed to a device for omnidirectional image viewing within a hemispherical field-of-view. Zimmermann, in particular, teaches a system that is capable of creating the effect that an image is moved, i.e., panning, as well as provide functions of pan or tilt of an image over at least 180°, image rotation/magnification, or real-time video capability over an image of at least 180°. Relying on the hardware in Juday would substantially limit the functions of Zimmermann such that it would not be capable of its intended functions. Thus, Applicants submit that a person of ordinary skill would not look to the teachings in Juday as a substitution and thereby an improvement to the operations of Zimmermann.

Also, Applicants submit that based on the teachings of Juday a person of ordinary skill in the art would not be motivated to first change the software disclosed in Zimmermann to use specific hardware as in the present claimed invention, and then second include the look-up table of a trigonometric function for performing coordinate transformation. Such picking and choosing from any

one reference only so much as will support a given position, to the exclusion of other parts necessary to the full appreciation of what such reference fairly suggests to one of ordinary skill in the art is impermissible. In re Wesslau, 147 USPQ 391, 393 (CCPA 1965). Thus, Applicants submit that one of ordinary skill in the art would not be motivated to combine Zimmermann and Juday, as contended by the Examiner.

Furthermore, Juday fails to teach or suggest specific hardware elements of the claimed invention.

First of all, as previously mentioned, Juday is directed to a programmable remapper that works with a conventional video camera. It is not directed to transformation of image data derived from an image over a 360° view field area. Thus, Juday does not at least teach or suggest the claimed image transformation section in the context claimed.

Second of all, Juday does not teach or suggest a look-up table of a trigonometric function that is used to achieve transformation of polar coordinates to rectangular coordinates. Neither the factor look-up table 36 or the address look-up table 34a disclosed in Juday are of a trigonometric function. Rather, the factor look-up table 36 only produces weighting factors to be used to achieve the remapping of two-dimensional video images. The address look-up table 34a is for associating addresses with pixels.

Furthermore, Juday does not disclose an arithmetic/logic circuit performing coordinate transformation of a polar coordinate when the image data is transformed into the display data as a rectangular coordinate making reference

to a lookup table of a trigonometric function. The Office Action alleges that the multipliers 30 and 68, and the adders 42 and 72 constitute an arithmetic/logic circuit for performing coordinate transformation. However, Juday is directed to a general purpose programmable remapper that works with input preferably from a conventional video camera. The transformations that the programmable remapper performs are from one Cartesian matrix to another Cartesian matrix (column 5, lines 15, 21-26). Thus, Juday does not teach or suggest the claimed arithmetic/logic circuit for performing polar to rectangular image transformation using a look-up table of a trigonometric function.

Thus, Applicants submit that at least for these reasons, the rejection fails to establish *prima facie* obviousness for claim 1.

With respect to claim 3, claim 3 is directed to first performing zoom-in or zoom-out processing or pan/tilt processing, then performing one of panoramic or prospective processing. As disclosed on page 22 of the present specification, Applicants have found that by following such a procedure, transformation can be carried out without a need for an additional buffer memory. Thus, as a result of the sequence of operations transformation can be carried out without a need for an additional buffer memory. Juday fails to teach or suggest this procedure as part of image transformation. Accordingly, at least for this additional reason, Juday, either alone or in combination with the Zimmermann/Masaharu, fails to teach or suggest all elements of claim 3.

With respect to claims 10 and 11, the Office Action alleges that the limitations recited in claims 10 and 11 are met by Juday, and states as an

example that Juday clearly teaches a pan function. Applicants disagree. The claims are not just directed to performing a pan function, or a pan/tilt function, etc. Rather, claim 10 is directed to a panoramic transformation circuit which alternatively performs a pan function (e.g., as shown in Figure 6). Claim 11 is directed to a perspective transformation circuit which alternatively performs a pan/tilt function or a zoom-in/zoom-out function (e.g., as shown in Figures 7 and 8). In other words, the claims are directed to circuits that perform alternative functions, and only require changing one or two parameters to perform the alternative function. Applicants submit that Juday fails to teach or suggest such circuits. Thus, Applicants submit that Zimmermann/Masaharu and Juday, either alone or in combination, fail to teach all claimed limitations of claims 10 and 11.

With respect to the remaining dependent claims, at least for the same reasons as above for claim 1, Zimmermann/Masaharu and Juday, either alone or in combination, fail to teach or suggest all of the claimed elements of those claims as well. Accordingly, Applicants respectfully request that the rejection under 35 U.S.C. 103 be withdrawn.

CONCLUSION

In view of the above remarks, reconsideration of the rejections and allowance of each of claims 1-11 in connection with the above identified application is earnestly solicited.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Robert W. Downs (Reg. No. 48,222) at the telephone number of the undersigned below, to

arrange for an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS

The claims have been amended as follows:

1. (Amended) An omniazimuthal visual system, comprising:

an optical system capable of obtaining an image of 360° view field area therearound and capable of central projection transformation for the image;

an imaging section for converting the image obtained through the optical system into image data represented by polar coordinates;

an image transformation section for transforming the image data into display data represented by rectangular coordinates;

a display section for displaying a transformed image based on the display data from the image transformation section; and

a display control section for controlling the transformed image to be displayed on the display section,

wherein the image transformation section includes

at least one buffer memory for temporarily storing the image data and the display data,

an arithmetic/logic circuit for performing coordinate transformation of a polar coordinate when the image data is transformed into the display data[,] as a rectangular coordinate with reference to a lookup table of a trigonometric function [for use in the arithmetic/logic circuit], and

a CPU for controlling the at least one buffer memory, the arithmetic/logic circuit, and the lookup table.